Marc Hellwig

Universität Mainz

IceCube DAQ Meeting, Berkeley, 28.10.2002

SN DAQ for IceCube

- Expected Signal
- Time resolution in Simulation
- Artificial Deadtime and Thresholds
- New DAQ and SNEWS
- Summary

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Expected Signal

- Signal in a H_2O Cherenkovtelescope

taken from Burrows et. al: The future of supernova neutrino detection

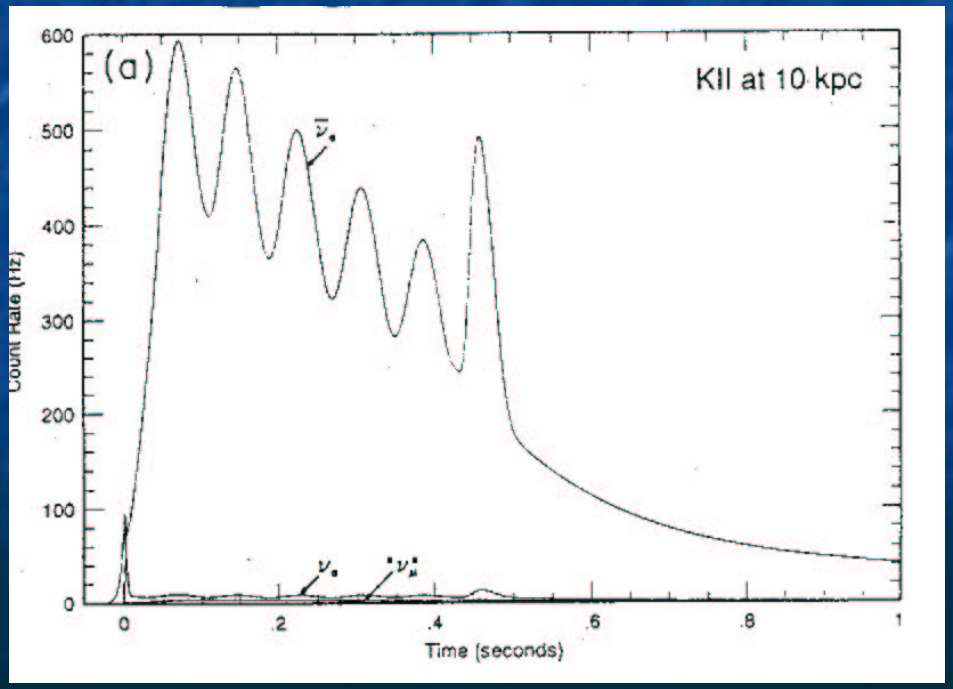
- SN detection with neutrino telescopes

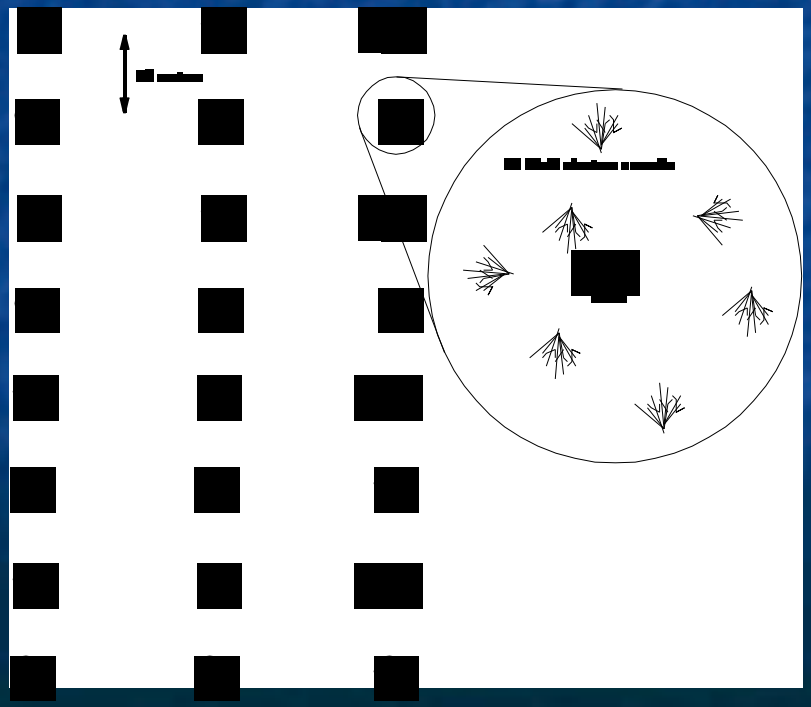
Energy of the $\bar{\nu}_e$ in the range of multiple MeV

For trace reconstruction with Amanda approx. 100 GeV necessary

But: $\bar{\nu}_e + p \rightarrow e^+ + n$ creates 110 counts signal on top of the normal noise (center of the galaxy 8.5 kpc)

Number of counts was approximated using the 1987a Kamiokande data





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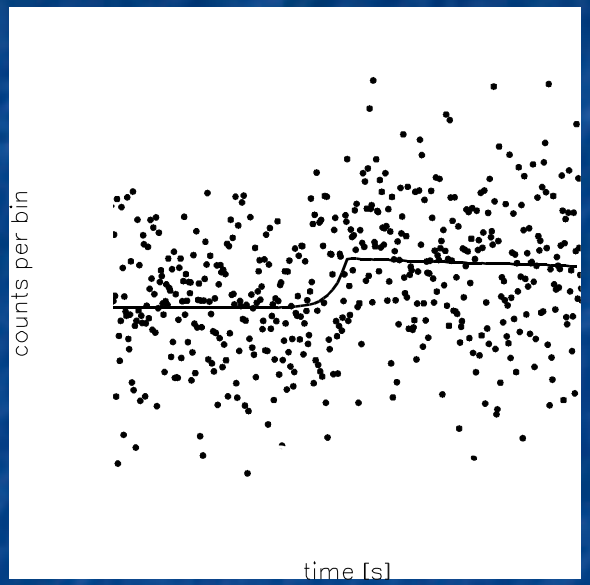
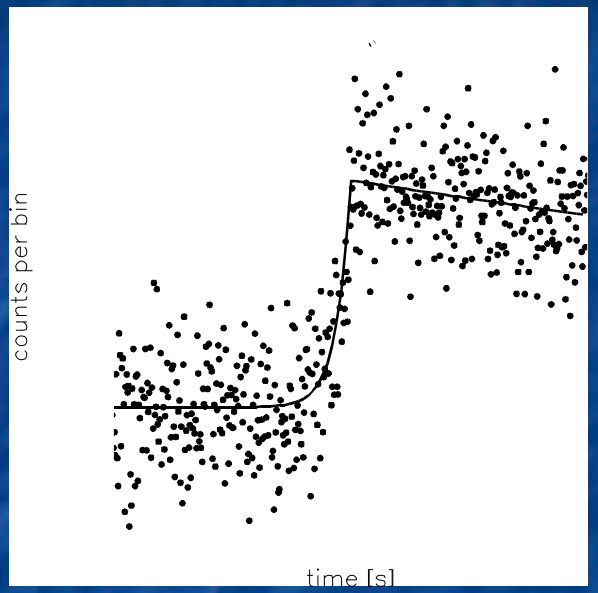
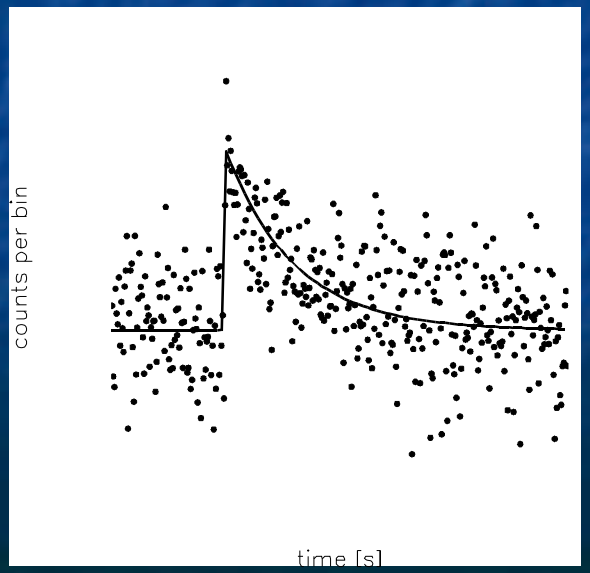
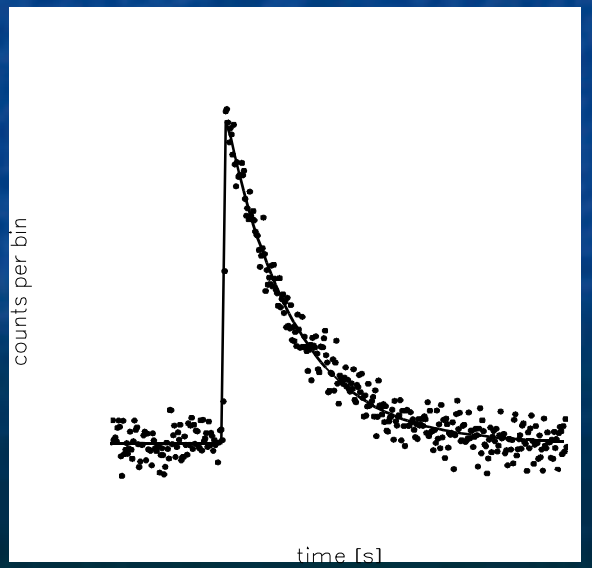
Expected Signal

- Statistical significance can be seen only when the signals of many OMs are getting summed up
- Low Noiserates of individual modules improves S/N dramatically
  (In the SN analysis: weight factor for B4 modules = 1.0, B19 modules = 0.2 !)
- Measurement of integrated -energy possible
- No directional or spectral informations available
- For triangulation with other telescopes we need good time resolution. Effect of binning size ?









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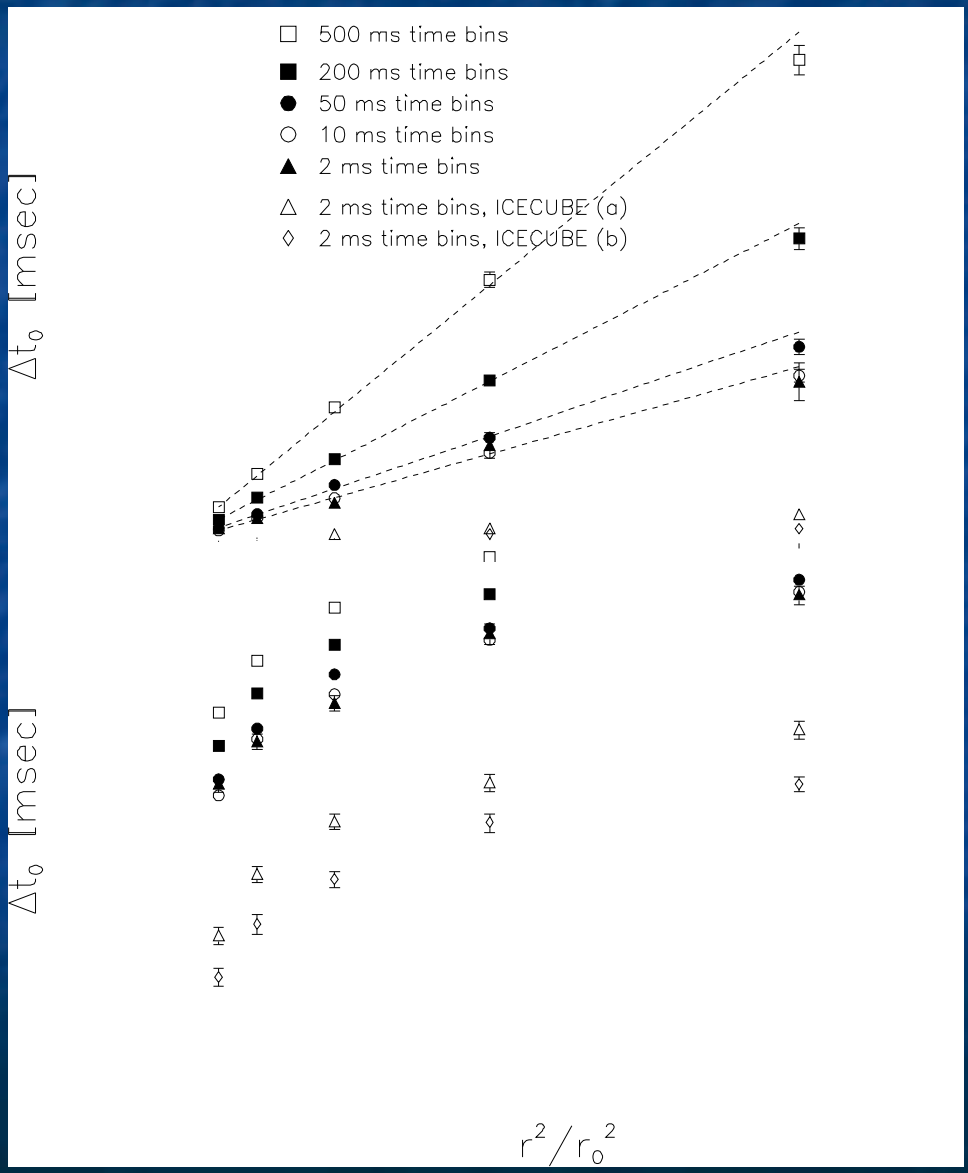
Time resolution in simulation

- Comparison between the Amanda and IceCube time resolutions in a MC for different binning sizes
- These numbers are for a known time structure of the neutrino emission !
- For IceCube we want a binning of at least 10ms, going down to 2ms would make sense



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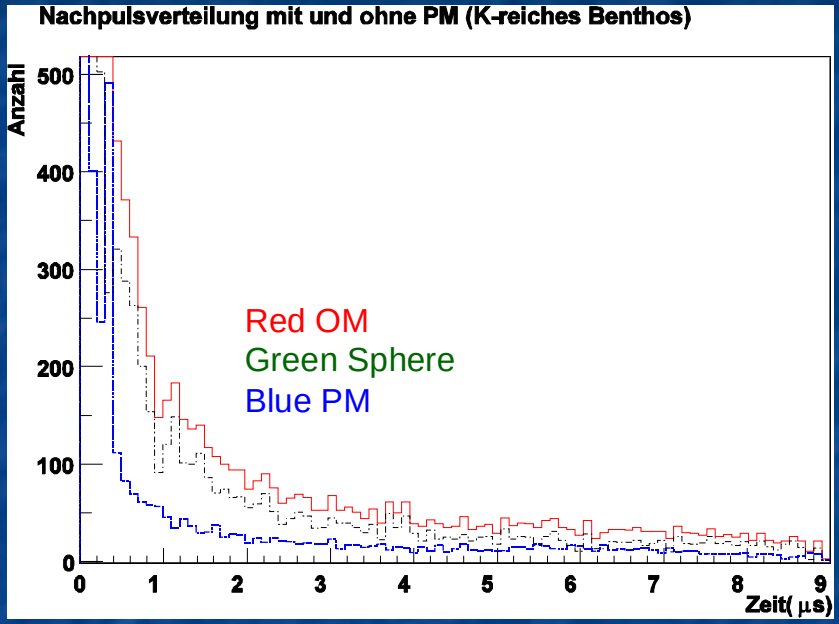
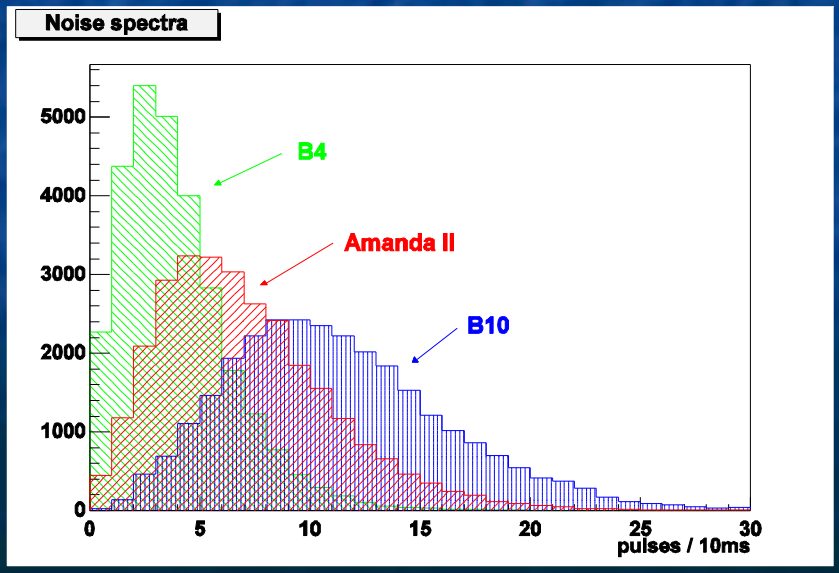
Artificial Deadtime & Thresholds

- Material of glass sphere is important for reducing noise rate
- Afterpulses and electronic artifacts due to high gain lead to widening of the pulse distribution. We use an artifical deadtime to reduce effects on analysis
  (at the moment deadtime AII = 256µs)





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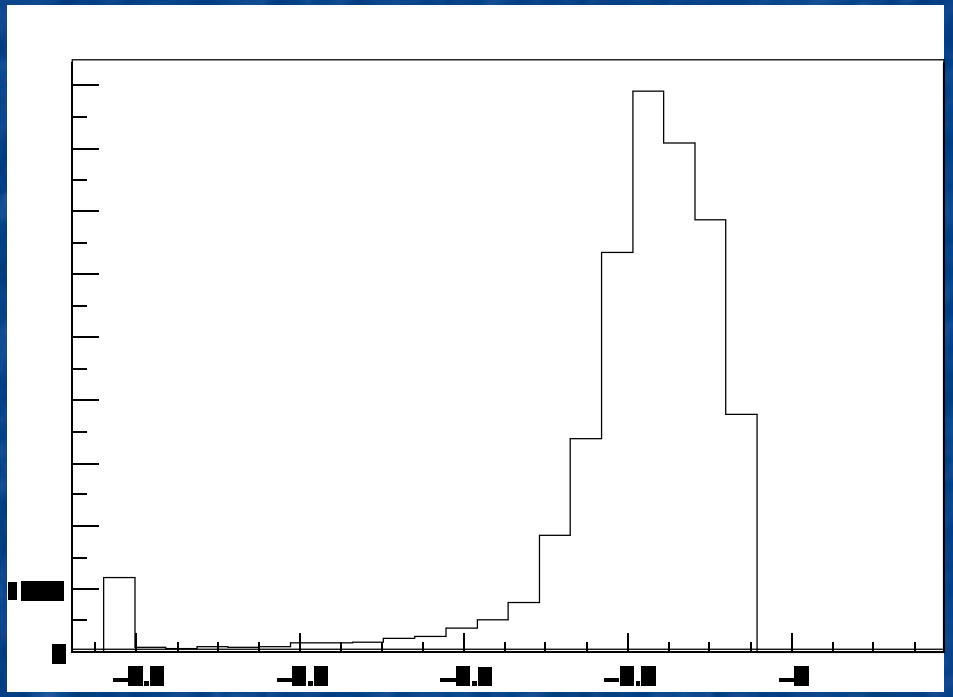
Artificial Deadtime & Thresholds

- Distribution of maximum pulse amplitudes shows a long tail at high amplitudes
  (negative Voltages on x-axis)
- This seems to be an electronic artifact

Is it possible to have a second discriminator threshold to remove these pulses ?



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New DAQ and SNEWS

- New DAQ for SN system is under development
- XML for configuration files
- ROOT gets used for I/O, Threads, Port communication to make source maintenance easier (and less overhead in source code)
- Output files are in ROOT format and therefore can be analysed directly
- Integration of realtime Likelihood analysis in DAQ for participation in SNEWS
- Software is scalable for usage with IceCube
- Installation this season planned but rollback to old DAQ possible

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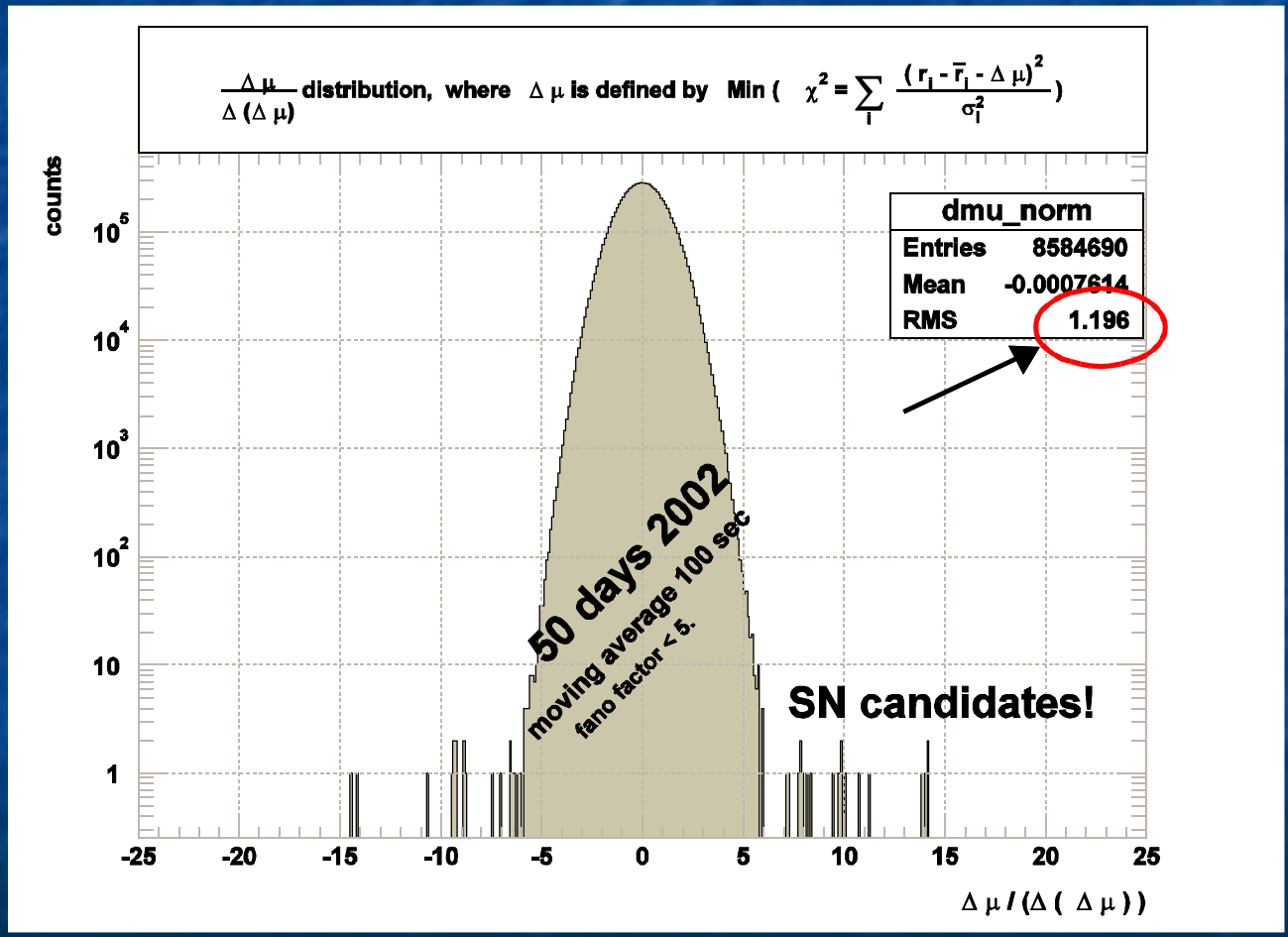
New DAQ and SNEWS

- Calculation of moving average and moving sigma for Likelihood maximation
- Automatic selection of noisy channels
- Fast enough to run as a part of the DAQ
- We'll test a sandbox version of the SNEWS alarm function this season



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Summary

- Useful binning for IceCube would be 10ms or better
- Artificial deadtime helps reducing afterpulses and electronic artifacts. Settings up to 1ms are desirable
- Upper Threshold for discriminator can possibly further reduce electronic noise (further investigation in progress)
- New DAQ using established software standards (XML, ROOT) under development that can be scaled up for IceCube usage
- Online Likelihood Analysis of Signal finished, will be included in Software Upgrade this season
- Trigger for SN alert system will be tested in Winter